national accelerator laboratory

TM-392
2530

A SELF-ADAPTIVE "ANALOG SCALER" SYSTEM FOR GENERATING BEAM PROFILES IN SECONDARY BEAM LINES WITH LOW PARTICLE COUNTS

F. Hornstra

September 22, 1972

A variation of the SWIC scanner method is proposed to obtain beam profiles in secondary beam lines with particle count below that presently obtainable with proportional chambers directly connected to the SWIC scanner. The proposed system retains the basic simplicity of generating profiles directly on an oscilloscope. Also incorporated is the self-adaptive feature found in the digital scaler system designed by R. G. Martin and the author whereby counting is automatically stopped on all channels when any channel overflows. Thus, even though the channel capacity is limited, the system is unaffected by the total number of particles during a beam spill as long as the particle rate does not exceed the capability of the electronics.

One channel of the system is illustrated in Fig. 1. A proportional chamber with a local amplifier is shown as the detector although any counter detector would be acceptable. The pulses received at the profile generator are standardized by an economical (37 cents) precision Schmitt Trigger. The standardized pulses are then accumulated in an "analog scaler" consisting of a low leakage and yet economical ($14.00) operational amplifier integrator.

During the beam spill, the outputs of the integrators are frequently sampled to monitor their voltage. When any channel is full, as determined by an adjustable comparator, a latch is set which inhibits all channels from receiving further counts. A normalized profile is thereby locked in the system. Charge leakage from the capacitor will be equivalent to 1 particle count per 100 msec; therefore, integration times exceeding one second are feasible.

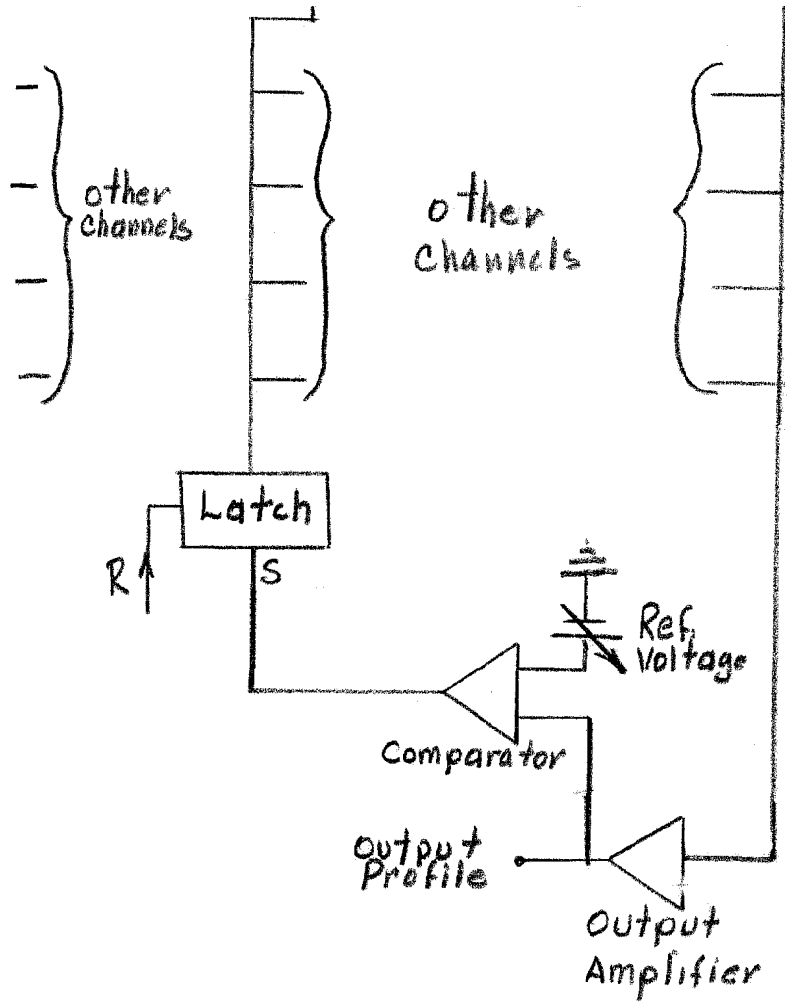
The value of this system lies not so much in the "analog scaler" but in having quantitative profiles displayable directly and simply on an oscilloscope. If digital data were required, one analog to digital converter operating in synchronism with the scanner would suffice.

The cost of the system components is ~$20 per channel so 32 channels would cost ~$700.

If profiles from several locations are not required simultaneously, several groups of detectors could be connected in parallel to this system. Switching high voltage exclusively to the detector determines which profile is accumulated and displayed.

Although the "analog scaler" could be attached to any SWIC scanner, the multiplexing requirements here are less severe, and a simpler and cheaper multiplexer should be included as a part of the unit to make a "stand-alone" system.

The author wishes to thank R. G. Martin for his helpful discussions.


other channels
other channels
Latch
R
S
Ref. Voltage
Comparator
output Profile
Output Amplifier